AMENDMENTS TO THE CLAIMS

1. (PREVIOUSLY PRESENTED) A lithographic projection apparatus comprising:

a radiation system for supplying a projection beam of radiation;

a support structure for holding patterning structure, the patterning structure serving to pattern the projection beam according to a desired pattern;

a substrate table for holding a substrate;

a projection system for projecting the patterned beam onto a target portion of the substrate;

a level sensor for measuring at least one of a perpendicular position and tilt about at least one parallel axis of a surface of an object held by one of the support structure and the substrate table, and generating a position signal indicative thereof, perpendicular referring to a direction substantially perpendicular to the said surface and parallel referring to a direction substantially parallel to said surface;

a servo system responsive to said position signal for moving said object to a desired position; and

a filter connected between said level sensor and said servo system for filtering said position signal, the filter having a transfer function representative of a difference between an actual measurement of the level sensor and an ideal measurement of the level sensor.

2. (ORIGINAL) Apparatus according to claim 1, wherein the filtered position signal forms a setpoint for said servo system.

3. (ORIGINAL) Apparatus according to claim 2, wherein said filter is a low-pass filter arranged to pass components of said position signal having a spatial frequency lower than a predetermined spatial frequency.

4. (ORIGINAL) Apparatus according to claim 3, wherein at least one of the support structure and the substrate table are moveable to effect a scanning exposure of a substrate held on said substrate table, and said predetermined spatial frequency is

substantially equal to 1 divided by the width of said projection beam in the scanning direction of the apparatus.

5. (ORIGINAL) Apparatus according to claim 1, wherein said filter is adapted to reduce cross-talk between rotation of said object about a parallel axis and parallel translations of said object.

6. (ORIGINAL) Apparatus according to claim 1, further comprising a position sensor for detecting a position of said at least one of said support structure and said substrate table, an output of said position sensor being subtracted from an output of said level sensor to form said position signal; and wherein said servo system comprises an inner control loop including said position sensor for controlling the position of said at least one of said support structure and said substrate table, and said filtered position signal forms a setpoint for said inner control loop.

7. (ORIGINAL) Apparatus according to claim 6, wherein said position sensor comprises an interferometric displacement measuring system or a Linear Variable Differential Transformer (LVDT) measuring system.

8. (ORIGINAL) Apparatus according to claim 1, wherein at least one of said support structure and said substrate table are moveable to effect a scanning exposure of a substrate held on said substrate table, and said level sensor is arranged to measure at least one of the perpendicular position and the tilt about at least one parallel axis of a measurement point on said surface of said object ahead of the center of said projection beam in the scanning direction.

9. (ORIGINAL) Apparatus according to claim 8 further comprising a position sensor for detecting a position of said at least one of said support structure and said substrate table, an output of said position sensor being subtracted from an output of said level sensor to form said position signal; and wherein said servo system comprises an inner control loop including said position sensor for controlling the position of said at least one of said support

structure and said substrate table, and said filtered position signal forms a setpoint for said inner control loop, wherein said position sensor is arranged to measure the position of said at least one of said support structure and said substrate table at a point corresponding to said measurement point of said level sensor.

10. (ORIGINAL) Apparatus according to claim 8, wherein the distance of said measurement point ahead of said center of said projection beam is dependent on the speed of said scanning exposure.

11. (ORIGINAL) Apparatus according to claim 8, wherein said filter has a transfer function that is dependent on the speed of said scanning exposure.

12. (ORIGINAL) Apparatus according to claim 1, wherein said object is one of the patterning structure and the substrate held by one of the support structure and substrate table, respectively.

13. (ORIGINAL) Apparatus according to claim 1, wherein the support structure comprises a mask table for holding a mask.

14. (PREVIOUSLY PRESENTED) A method of manufacturing a device comprising:

providing a substrate that is at least partially covered by a layer of radiation-sensitive material;

providing a projection beam of radiation;

patterning the projection beam to produce a pattern in its cross-section;

measuring at least one of a perpendicular position and tilt about at least one parallel axis of a surface of an object with a level sensor and generating a position signal indicative thereof, perpendicular referring to a direction substantially perpendicular to the said surface and parallel referring to a direction substantially parallel to said surface;

projecting the patterned beam of radiation onto a target portion of the layer of radiation-sensitive material while operating a servo system responsive to said position signal to maintain said object at said desired position; and

filtering said position signal to form a filtered position signal using a filter transfer function representative of a difference between an actual measurement of the level sensor and an ideal measurement of the level sensor before it is used by a servo system to control the position of the object.

15. (ORIGINAL) A device manufactured according to the method of claim 14.

16. (AMENDED) A lithographic projection apparatus comprising:

a radiation system for supplying a projection beam of radiation;

a support structure for holding patterning structure, the patterning structure serving to pattern the projection beam according to a desired pattern;

a substrate table for holding a substrate;

a projection system for projecting the patterned beam onto a target portion of the substrate;

a level sensor for measuring at least one of a perpendicular position and tilt about at least one parallel axis of a surface of an object held by one of the support structure and the substrate table, and for generating a position signal as a function of time indicative thereof, perpendicular referring to a direction substantially perpendicular to the said surface and parallel referring to a direction substantially parallel to said surface;

a servo system responsive to said position signal for moving said object to a desired position; and

a filter for correcting the transfer function of the level sensor, wherein the filter is arranged for filtering said position signal in the time domain

~~a time-domain filter connected between said level sensor and said servo system for filtering said position signal~~.

17. (AMENDED) A method of manufacturing a device comprising:

providing a substrate that is at least partially covered by a layer of radiation-sensitive material;

providing a projection beam of radiation;

patterning the projection beam to produce a pattern in its cross-section;

measuring at least one of a perpendicular position and tilt about at least one parallel axis of a surface of an object with a level sensor and generating a position signal as a function of time indicative thereof, perpendicular referring to a direction substantially perpendicular to the said surface and parallel referring to a direction substantially parallel to said surface;

projecting the patterned beam of radiation onto a target portion of the layer of radiation-sensitive material while operating a servo responsive to said position signal to maintain said object at said desired position; and

filtering said position signal in the time domain by using a filter transfer function for correcting the transfer function of the level sensor before it is used by said servo system to control the position of the object

~~time domain filtering said position signal before it is used by said servo system to control the position of the object~~.

REMARKS

Claims 1-17 are pending in the application. By this Preliminary Amendment, claims 16 and 17 have been amended. Claims 1-15 have been allowed.

This Preliminary Amendment is being filed with a Request for Continued Examination (RCE). This Preliminary Amendment addresses the Final Office Action dated May 1, 2002 and the Advisory Action dated October 8, 2003.

Claims 16 and 17 are rejected under 35 U.S.C. §102(e) over Miyachi, U.S. Patent No. 6,400,456. Also, claims 16 and 17 are rejected under 35 U.S.C. §103(a) over van der Werf, U.S. Patent No. 5,191,200, in view of Miyachi. Applicants respectfully request the Examiner to reconsider these rejections based on the amendments to claims 16 and 17 and the following distinguishing comments.

For example, claim 16 recites a lithographic projection apparatus comprising, among other elements, a filter for correcting the transfer function of the level sensor, wherein the filter is arranged for filtering the position signal in the time domain. Claim 17 recites a method of manufacturing a device comprising, among other features, filtering the position signal in the time domain by using a filter transfer function for correcting the transfer function of the level sensor before it is used by the servo system to control the position of the object.

As discussed in Applicants' Request for Reconsideration After Final Rejection dated September 2, 2003, the arithmetic section/filter means of Miyachi filters signals in the spatial domain, not the time domain as recited in independent claim 16.

Moreover, col. 12, lines 26-28 of Miyachi state "the above operation [relating to servo control] is repeatedly performed at a certain interval in synchronization with the position of the stage on which the substrate 15 is placed in the scanning direction," which clearly indicate that Miyachi performs spatial filtering and not time domain filtering as claimed. That is, Miyachi is directed to the use of a spatial domain filter that is particularly adapted to correct for errors resulting from spatial characteristics of the scanning slit (see col. 14, lines 17-26). In contrast, the present invention uses a filter for correcting the transfer function of the level sensor, wherein the filter is arranged for filtering the position signal in the time domain, as recited in claim 16.

Thus, the filter according to Miyachi is a filter in the spatial domain which relates to the slit opening for filtering out certain spatial frequencies, while the filter according to claim

16 filters in the time domain. The different character of a time filter with respect to a spatial filter is especially relevant if the scanning speed varies as a function of time.

Furthermore, Miyachi's apparatus does not filter the position signal in the time domain by using a filter transfer function for correcting the transfer function of the level sensor before it is used by the servo system to control the position of the object, as recited in claim 17. Thus, the filter means of Miyachi is not a filter as recited in claim 16, nor does Miyachi disclose the claimed method of manufacturing as recited in claim 17. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 16 and 17 under Miyachi.

The Office Action admits that van der Werf fails to disclose a time domain filter or time domain filtering and relies on Miyachi for its disclosure of the arithmetic section or filter means. Accordingly, van der Werf does not make up for the deficiencies noted above with respect to Miyachi. Withdrawal of the rejection of claims 16 and 17 under van der Werf in view of Miyachi is respectfully requested.

Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, he is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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